14. BATESIAN MIMIC BUTTERFLIES TAKEN IN BY THEIR MODELS AND THE MIMETIC STATUS OF *ARGYREUS HYPERBIUS* L. (NYMPHALIDAE)

Two types of inter-butterfly mimicry are known: Batesian mimicry, where palatable butterflies mimic unpalatable species in order to escape predation; Müllerian mimicry, where unpalatable species, often unrelated, develop very similar wing patterns and behaviour in order to reduce the cost of advertising their unpalatability to naive predators.

The phenomenon of Batesian mimicry involves three participants: a model, a mimic and an audience who is intended to be deceived by the mimic. The audience is believed to consist of insectivorous birds, lizards and perhaps some amphibians. In many cases, mimicry is restricted to the females, while males of the mimic look and behave very differently from the models.

It sometimes happens that there are unintended victims of deception. Peile (1937) mentioned two such instances. He stated "I have on several occasions seen a male *Hypolimnas misippus* L. (Danaid Eggfly) chasing a *Danaus chrysippus* L. (Plain Tiger)...." And "The female (of *Argyreus hyperbius* Johannsen, the Indian Fritillary) somewhat resembles *Danaus* (now *Salatura*) *genutia* Cramer (Common Tiger), and I have taken it in company with that species at flowers. The male (of *A. hyperbius*) is a fast flier, whereas the female, I observed, got up in a leisurely way and sailed, Danaid-like, over the bushes, and I have netted female. *A. hyperbius*, mistaking it for a *D. genutia*."

In the morning, on October 8, 2001, I witnessed an interesting interaction. A worn male *A. hyperbius* had established a beat on our front lawn which, after the rainy season, was covered with a rank profusion of grasses and low growing plants, interspersed with stands of Cosmea I to 3 m high. At 1015 hrs, what appeared to be a female *A. hyperbius* came by from the east and was immediately pounced upon by the male *A. hyperbius*, who forced her to the ground six or eight times in a typical preliminary act of courtship. The female arose each time and made a few yards progress before being forced down again. I thought nothing of the matter until the pair came nearer and I felt that the flight of the female was too perfectly like a *D. chrysippus* for a female *A. hyperbius* to maintain under the circumstances.

The female settled briefly on a Cosmea plant, enabling me to see that it was, in fact, a *D. chrysippus*, not an *A. hyperbius*. Meanwhile, the *A. hyperbius* male settled on a low growing shrub behind the Cosmea stand. When the *D. chrysippus* took wing a little over a minute after settling, it made off fast and low behind the Cosmea, out of the line of vision of the male *A. hyperbius*. The latter, perhaps having realised his mistake, made no move to harass the *D. chrysippus* further.

During the next hour, the male *A. hyperbius* also checked some passing individuals of *Neptis sappho* Pallas (Pallas' Sailer), *Papilio polytes* L. (Common Mormon) and a fresh male *A. hyperbius* who did not challenge the worn *A. hyperbius* for the beat and moved on without stopping.

Evans (1932a) and Wynter-Blyth (1957) treat female *A. hyperbius* as a Batesian mimic of *D. chrysippus*, while Peile (1937) found female *A. hyperbius* in the company of *S. genutia* and even mistook female *A. hyperbius* for *S. genutia*. Larsen (1987) stated that *A. hyperbius* females are very respectable mimics of *S. genutia*. The worn *A. hyperbius* male mentioned above mistook a *D. chrysippus* for his mate. Although it is difficult for an experienced human eye to confuse *D. chrysippus* and *S. genutia* on the wing, from the above references, it appears that *A. hyperbius* females can evidently pass themselves off as either of these species.

Perusal of the literature revealed that the putative Batesian relationship between *S. genutia* and *D. chrysippus* on the one hand and female *A. hyperbius* on the other (Evans 1932a; Wynter-Blyth 1957) had not been empirically proven, in that although the unpalatability of *S. genutia* and *D. chrysippus* are well known (Emmel 1976; Watson and Whalley 1983; Larsen 1987), the monotypic genus *Argyreus* Scopoli was not definitely known to be palatable. There is a brief account of attacks on *A. hyperbius* males (but not females) by Red-whiskered Bulbuls (*Pycnonotus jocosus*) at Longwood Shola near Kotagiri in the Nilgiris (Larsen 1987).

In order to confirm the palatability of *A. hyperbius*, I offered three female and eight male *A. hyperbius* to wild, free ranging, foraging parties of generalised insectivorous birds (mainly *Garrulax albogularis* and *Garrulax leucolophus*). The freshly collected, dead butterflies were presented with the wings closed, so that the mimetic pattern on the *recto* surface of the female's wings was not visible, thus precluding possible preconditioned visual aversion to the female butterflies on the part of the birds. The butterflies were offered sporadically over a period of three years as part of a larger experiment involving other butterfly species. Nine of the *A. hyperbius* specimens were eaten, of which eight were entirely eaten, including all three females. The birds showed no aversion to the butterflies and no distress behaviour was noted while the butterflies were being tasted and manipulated prior to being swallowed or immediately after they were swallowed.

A. hyperbius is known from Abyssinia and along the

Himalaya to Mount Abu, the Nilgiris, Palnis, High Wavys and Sri Lanka north to Japan and Korea and south to eastern Australia. Both the models also occur throughout this range except in Abyssinia and Papua New Guinea, where *S. genutia* does not occur (Shirozu 1960; Lewis 1974; Larsen 1987, 1988). However, the very similar *Salatura philens* Cramer occurs in Papua New Guinea. In Japan, the status of the mimetic relationship is unclear, since both the models are migrants while *A. hyperbius* is a common resident, with up to five annual generations (Kudrna 1974).

Of the eight subspecies of *A. hyperbius* known (Shirozu 1960; Samson 1976), seven are sexually dimorphic with mimetic females, while females of the race *castetsi* Oberthür, from the Western Ghats south of Palghat and the Palni Hills are apparently non-mimetic. *A. hyperbius* is common in suitable localities in the Palni Hills (Evans 1910; pers. obs.) all the year round, so its abstinence from mimicry does not seem to have greatly affected its capacity to survive or thrive.

In terms of altitude, *A. hyperbius* is found from nearly 3000 m in Papua New Guinea (Samson 1976) to 400 m on the plains of northern India (Larsen 1988), but it is commonest between 1200 m and 2200 m in India (*nilgi*) and from 2000 m to 3000 m in Papua New Guinea (Samson 1976). In India, both models are common at low elevation, rarely ascending over 2000 m. The zone in the Himalaya, where all three species are common, is between 1200 m and 1600 m.

The flying time of all three species coincides in all the areas for which information is available, i.e. Baluchistan (Evans 1932b), Chitral (Leslie and Evans 1903), Shimla (de Rhé Philipe 1931), Mussoorie (Mackinnon and de Nicéville 1897-98), Nepal (Bailey 1951) Kumaon (pers. obs.), the Palni Hills (Evans 1910) and the Naga Hills (Tytler 1911-12).

In view of the above facts, namely that *A. hyperbius* and the danaines are sympatric; are on the wing at the same time; are found in each other's company; in the case of *A. hyperbius*, females have a wing pattern similar to the danaines and often affect a flight and other behaviour patterns very similar to the danaines; and that the danaines are known to be unpalatable while *A. hyperbius* is palatable to birds, at least in some parts of its range, e.g. The Kumaon Himalaya and the Nilgiri Hills, it is possible to state with reasonable certainty that *A. hyperbius* females are Batesian mimics of *D. chrysippus* and *S. genutia* in India and possible of some additional, similar looking models in other parts of its range, e.g. Papua New Guinea.

Therefore, the observation of the interaction between the male *A. hyperbius* and the *D. chrysippus* described above is a case of a Batesian mimic taken in by its model.

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